

CLAIMS

What is claimed is:

- 1 1. In a vane pump operable for generating a vacuum and including a
2 rotor mounted for rotation within a housing to define an eccentric chamber between a
3 peripheral edge of the rotor and an inner wall surface of the housing, the rotor including
4 a plurality of slots extending inwardly from the peripheral edge and the vane pump
5 further including a plurality of elongated vanes each disposed in a respective one of the
6 slots for outward sliding movement of the vanes in and along the slots from a
7 nonoperating position in which an outer end of each vane is disposed in spaced relation
8 to the housing inner wall surface and an operating position in which the outer end of
9 each vane is disposed in contact with the inner wall surface by centrifugal force acting
10 on the vanes as the rotor is rotated within the housing during vacuum-generating
11 operation of the vane pump, the improvement comprising:
12 a first stop on each of the slots; and
13 a second stop located on each of the vanes for releasable engagement
14 with the first stop of the respective slot to capture through said releasable engagement
15 at least a longitudinal inner portion of each vane within the respective slot, said first and
16 second stops being positioned on the slots and vanes so that, as frictional contact of the
17 each vane outer end with the housing inner wall surface as the vane pump is operated
18 causes gradual wear-based erosion of the each vane outer end to thereby longitudinally
19 shorten the each vane and require added centrifugal force-induced outward sliding
20 movement of the each vane from the first to the second position for attaining contact of

21 the each vane outer end with the housing inner wall surface, the engagement of the first
22 and second stops prevents continued outward sliding movement of the each vane
23 beyond a predetermined point to maintain the at least a longitudinal inner portion of the
24 each vane within the respective slot, wherein each said vane comprises a tapered
25 sidewall that defines said second stop.

1 2. In a vane pump in accordance with claim 1, wherein said first stop
2 on each said slot comprises a shoulder integrally defined on a wall of said each slot.

1 3. In a vane pump in accordance with claim 2, wherein said second
2 stop on each said vane comprises a shoulder integrally defined on a wall of said each
3 vane.

1 4. In a vane pump in accordance with claim 1, wherein each said slot
2 comprises a tapered sidewall that defines said first stop.

1 5. In a vane pump in accordance with claim 1, further comprising a
2 sensor for detecting engagement of said first and second stops.

1 6. In a vane pump in accordance with claim 5, wherein said sensor
2 comprises a switch mounted for actuation by said engagement of the first and second
3 stops.

4 7. In a vane pump in accordance with claim 1, wherein each said slot
5 is substantially radially aligned with an axis of rotation of the rotor.

1 8. In a vane pump in accordance with claim 1, wherein said first stop
2 comprises a constriction defined in each said slot proximate said rotor peripheral
3 surface.

1 9. A vane pump operable for generating a vacuum, comprising:
2 a housing having an inner wall surface;
3 a rotor having a peripheral edge and mounted for rotation within said
4 housing to define an eccentric chamber between said peripheral edge and said housing
5 inner wall surface, said rotor including a plurality of slots defined about the rotor, each of
6 said slots extending inwardly from said peripheral edge and including a first stop defined
7 on said each slot; and

8 a plurality of elongated vanes each disposed in a respective one of said
9 slots for outward sliding movement of the vanes, by centrifugal force acting on the
10 vanes as the rotor is rotated within the housing during vacuum-generating operation of
11 the vane pump, in and along the slots from a nonoperating position in which an outer
12 end of each vane is disposed in spaced relation to the housing inner wall surface and
13 an operating position in which the outer end of each vane is disposed in contact with the
14 inner wall surface;

15 each of said vanes having a tapered sidewall that defines a second stop
16 located on said each vane for releasable engagement with the first stop of the
17 respective slot to capture through said releasable engagement at least a longitudinal
18 inner portion of each vane within the respective slot;

19 said first and second stops being positioned on the slots and vanes so
20 that, as frictional contact of the each vane outer end with the housing inner wall surface
21 as the vane pump is operated causes gradual wear-based erosion of the each vane
22 outer end to thereby longitudinally shorten said each vane and require added centrifugal
23 force-induced outward sliding movement of said each vane along the respective slot
24 from the first to the second position for attaining contact of the each vane outer end with
25 the housing inner wall surface, said engagement of the first and second stops prevents
26 continued outward sliding movement of the each vane beyond a predetermined point to
27 maintain said at least a longitudinally inner portion of the each vane within the
28 respective slot.

1 10. A vane pump in accordance with claim 10, wherein said first stop
2 on each said slot comprises a shoulder integrally defined on a wall of said each slot.

1 11. In a vane pump in accordance with claim 10, wherein said second
2 stop on each said vane further comprises a shoulder integrally defined on a wall of said
3 each vane.

4 12. In a vane pump in accordance with claim 9, wherein each said slot
5 comprises a tapered sidewall that defines said first stop.

1 13. In a vane pump in accordance with claim 9, further comprising a
2 sensor for detecting engagement of said first and second stops.

1 14. In a vane pump in accordance with claim 9, wherein said sensor
2 comprises a switch mounted for actuation by said engagement of the first and second
3 stops.

1 15. In a vane pump in accordance with claim 9, wherein each said slot
2 is substantially radially aligned with an axis of rotation of the rotor.

1 16. In a vane pump in accordance with claim 9, wherein said first stop
2 comprises a constriction defined in each said slot proximate said rotor peripheral
3 surface.

1 17. In a vane pump operable for generating a vacuum and including a
2 rotor mounted for rotation within a housing to define an eccentric chamber between a
3 peripheral edge of the rotor and an inner wall surface of the housing, the rotor including
4 a plurality of slots extending inwardly from the peripheral edge and the vane pump
5 further including a plurality of elongated vanes each disposed in a respective one of the
6 slots for outward sliding movement of the vanes in and along the slots from a
7 nonoperating position in which an outer end of each vane is disposed in spaced relation
8 to the housing inner wall surface and an operating position in which the outer end of
9 each vane is disposed in contact with the inner wall surface by centrifugal force acting
10 on the vanes as the rotor is rotated within the housing during vacuum-generating
11 operation of the vane pump, the improvement comprising:

12 a first stop on each of the slots;

13 a second stop located on each of the vanes for releasable engagement
14 with the first stop of the respective slot to capture through said releasable engagement
15 at least a longitudinal inner portion of each vane within the respective slot, said first and
16 second stops being positioned on the slots and vanes so that, as frictional contact of the
17 each vane outer end with the housing inner wall surface as the vane pump is operated
18 causes gradual wear-based erosion of the each vane outer end to thereby longitudinally
19 shorten the each vane and require added centrifugal force-induced outward sliding
20 movement of the each vane from the first to the second position for attaining contact of
21 the each vane outer end with the housing inner wall surface, the engagement of the first
22 and second stops prevents continued outward sliding movement of the each vane
23 beyond a predetermined point to maintain the at least a longitudinal inner portion of the
24 each vane within the respective slot; and
25 a sensor for detecting engagement of said first and second stops.

1 18. In a vane pump in accordance with claim 17, wherein said first stop
2 on each said slot comprises a shoulder integrally defined on a wall of said each slot.

1 19. In a vane pump in accordance with claim 18, wherein said second
2 stop on each said vane comprises a shoulder integrally defined on a wall of said each
3 vane.

1 20. In a vane pump in accordance with claim 17, wherein each said slot
2 comprises a tapered sidewall that defines said first stop.

1 21. In a vane pump in accordance with claim 17, wherein said sensor
2 comprises a switch mounted for actuation by said engagement of the first and second
3 stops.

1 22. In a vane pump in accordance with claim 17, wherein each said slot
2 is substantially radially aligned with an axis of rotation of the rotor.

1 23. In a vane pump in accordance with claim 17, wherein said first stop
2 comprises a constriction defined in each said slot proximate said rotor peripheral
3 surface.

1 24. A vane pump operable for generating a vacuum, comprising:
2 a housing having an inner wall surface;
3 a rotor having a peripheral edge and mounted for rotation within said
4 housing to define an eccentric chamber between said peripheral edge and said housing
5 inner wall surface, said rotor including a plurality of slots defined about the rotor, each of
6 said slots extending inwardly from said peripheral edge and including a first stop defined
7 on said each slot;

8 a plurality of elongated vanes each disposed in a respective one of said
9 slots for outward sliding movement of the vanes, by centrifugal force acting on the
10 vanes as the rotor is rotated within the housing during vacuum-generating operation of
11 the vane pump, in and along the slots from a nonoperating position in which an outer
12 end of each vane is disposed in spaced relation to the housing inner wall surface and

13 an operating position in which the outer end of each vane is disposed in contact with the
14 inner wall surface;

15 each of said vanes including a second stop located on said each vane for
16 releasable engagement with the first stop of the respective slot to capture through said
17 releasable engagement at least a longitudinal inner portion of each vane within the
18 respective slot; and

19 a sensor for detecting engagement of said first and second stops;

20 said first and second stops being positioned on the slots and vanes so
21 that, as frictional contact of the each vane outer end with the housing inner wall surface
22 as the vane pump is operated causes gradual wear-based erosion of the each vane
23 outer end to thereby longitudinally shorten said each vane and require added centrifugal
24 force-induced outward sliding movement of said each vane along the respective slot
25 from the first to the second position for attaining contact of the each vane outer end with
26 the housing inner wall surface, said engagement of the first and second stops prevents
27 continued outward sliding movement of the each vane beyond a predetermined point to
28 maintain said at least a longitudinally inner portion of the each vane within the
29 respective slot;

1 25. In a vane pump in accordance with claim 24, wherein said first stop
2 on each said slot comprises a shoulder integrally defined on a wall of said each slot.

1 26. In a vane pump in accordance with claim 25, wherein said second
2 stop on each said vane comprises a shoulder integrally defined on a wall of said each
3 vane.

1 27. In a vane pump in accordance with claim 24, wherein each said
2 vane comprises a tapered sidewall that defines said second stop.

1 28. In a vane pump in accordance with claim 27, wherein each said slot
2 comprises a tapered sidewall that defines said first stop.

1 29. In a vane pump in accordance with claim 24, wherein said sensor
2 comprises a switch mounted for actuation by said engagement of the first and second
3 stops.

1 30. In a vane pump in accordance with claim 24, wherein each said slot
2 is substantially radially aligned with an axis of rotation of the rotor.

1 31. In a vane pump in accordance with claim 24, wherein said first stop
2 comprises a constriction defined in each said slot proximate said rotor peripheral
3 surface.

1 32. In a vane pump operable for generating a vacuum and including a
2 rotor mounted for rotation within a housing to define an eccentric chamber between a
3 peripheral edge of the rotor and an inner wall surface of the housing, the rotor including
4 a plurality of slots extending inwardly from the peripheral edge and the vane pump

5 further including a plurality of elongated vanes each disposed in a respective one of the
6 slots for outward sliding movement of the vanes in and along the slots from a
7 nonoperating position in which an outer end of each vane is disposed in spaced relation
8 to the housing inner wall surface and an operating position in which the outer end of
9 each vane is disposed in contact with the inner wall surface by centrifugal force acting
10 on the vanes as the rotor is rotated within the housing during vacuum-generating
11 operation of the vane pump, the improvement comprising:

12 a first stop on each of the slots; and

13 a second stop located on each of the vanes for releasable engagement
14 with the first stop of the respective slot to capture through said releasable engagement
15 at least a longitudinal inner portion of each vane within the respective slot, said first and
16 second stops being positioned on the slots and vanes so that, as frictional contact of the
17 each vane outer end with the housing inner wall surface as the vane pump is operated
18 causes gradual wear-based erosion of the each vane outer end to thereby longitudinally
19 shorten the each vane and require added centrifugal force-induced outward sliding
20 movement of the each vane from the first to the second position for attaining contact of
21 the each vane outer end with the housing inner wall surface, the engagement of the first
22 and second stops prevents continued outward sliding movement of the each vane
23 beyond a predetermined point to maintain the at least a longitudinal inner portion of the
24 each vane within the respective slot, wherein at least one of said first stop and said
25 second stop comprises a tapered sidewall.

1 33. In a vane pump in accordance with claim 32, wherein said first stop
2 comprises a shoulder integrally defined on a wall of at least one of said slots.

1 34. In a vane pump in accordance with claim 33, wherein said second
2 stop comprises a shoulder integrally defined on a wall of a vane corresponding to said
3 at least one slot.

1 35. In a vane pump in accordance with claim 32, wherein said slot
2 corresponding to said at least one vane comprises a tapered sidewall that defines said
3 first stop.

1 36. In a vane pump in accordance with claim 32, wherein engagement
2 of said first and second stops define an outward position of an outer tip of one of said
3 slots, said vane pump further comprising a sensor for detecting when said outward
4 position is reached.

1 37. In a vane pump in accordance with claim 36, wherein said sensor
2 comprises a switch.

1 38. In a vane pump in accordance with claim 32, wherein each said slot
2 is substantially radially aligned with an axis of rotation of the rotor.

1 39. In a vane pump in accordance with claim 1, wherein engagement of
2 said first and second stops define an outward position of an outer tip of one of said

3 slots, said vane pump further comprising a sensor for detecting when said outward
4 position is reached.

1 40. In a vane pump in accordance with claim 9, wherein engagement of
2 said first and second stops define an outward position of an outer tip of one of said
3 slots, said vane pump further comprising a sensor for detecting when said outward
4 position is reached.

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